

**MACHINE AND PROCESS FOR RECYCLING INORGANIC AND
ORGANIC TRASH AND OBTENTION OF A MOULDING-OBTAINING
MOLDABLE PASTE FOR DIFFERENT USAGES**

TECHNICAL FIELD

This invention refers to a machine and a process for recycling inorganic and organic trash and transformation of it into a molding paste for different usages, such as wood substitutions and construction materials.

BACKGROUND OF THE INVENTION

Currently, the conventional methods for the treatment of wastes generated in metropolitan areas, municipalities, towns and ranches, as well as tourist areas, naval, military, agricultural, commercial, roads, etc., are based mainly, in the separation of upon separating the same, according to its origin, in other words, all the foregoing wastes are transformed into either organic and or inorganic trash, the first one, Organic trash is commonly reincorporated into the nature that gave its origin environment, by means of the natural biodegradation process. In regards to inorganic trash, it is generally divided into types- metallic, or non-metallic; plastics of all kinds, forms and characteristics; glass, fibers and synthetic litters; rubber, etc.; in commercial amounts, ecologically and economically significant, same that which the recycling industry reincorporates, as raw materials for industrial processes in order to be processed again.

The great worldwide problem regarding the re-usage of inorganic wastes, can be considerably reduced by means of adequate machinery and processes. Therefore, after analyzing the foregoing problem, it was developed a machine, a process and a product were developed, this last one as a result of processing trash and which is transformed into different useful items. This machine, is efficient and represents a safe of savings in volume, space and energy, which is automated in all of its working stages, it can be operated by just one person, and does not require water in its process, characteristics that conventional recycling

machines lack. ~~Likewise~~likewise, this machine does not need special or environmental hygiene conditions. ~~This~~this machine also reduces the size of its raw material input (inorganic trash) 50 times or more ~~its~~by volume. ~~The and its~~ technological characteristics of the resulting product allow it to ~~become~~be made
 5 into useful and long lasting products, for people, ecology, industry, commerce, etc., ~~since it~~ It advantageously substitutes for wood, because it is not harmed by humidity or ~~moth~~termites, does not get rotten; and can be manufactured into materials for construction such as bricks, ~~vaults~~, floors, paving blocks; as well as columns, racks, staves, boards, planks, walls, beams, mudsills, divisions, parts for
 10 wood, automobile, craft and naval industry, as well as furniture, taps, sewers, frames, doors, windows, mallets, trash cans, flower stands, benches and vaults, among others.

These products when substituting for natural resources, contribute to reduce their exploitation, improve the environment, avoid cutting of trees, less alteration of
 15 the environment, and therefore, require less trash deposits.

~~At the moment it is~~A known the Method~~method~~ and Apparatus~~apparatus~~ to treat contaminated Plastic~~plastic~~ waste, comprising the densifying of plastic waste by making it ~~to~~pass through a heating zone to produce contaminated molten plastic, ~~is as described on patent in~~ PCT Patent Application NrNo. WO92/08590.
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The machine of ~~the patent~~ WO92/08590 utilizes as heating elements only electric resistors embedded in the walls of the so-called "Melting~~melting~~ Chamber~~chamber~~" (the manufacturing of this melting chamber is by a casting process with the electric resistors placed in the casting mold), and also ~~counts with~~has an electric resistor embedded in the central piece called a "spider", ~~this~~These manufacturing
 25 characteristics make the machine more complicated to manufacture and therefore more expensive.

~~We utilize~~Our new machine disclosed herein utilizes heated oil as a heating element which flows around and through the raw materials (inorganic and organic waste) by means of ~~the two~~ chambers that form the hallow~~hollow~~ walls, and the connecting pipes; ~~In on patent~~ WO92/08590, electric resistors are used as heating elements, ~~this which~~ means that the two machines use completely different Heating
 30 heating Elements~~elements~~.

In the machine ~~with in~~ patent WO92/08590 , the molten plastic flows by the influence of ~~the gravity, in ours~~ while in our machine, due to the type of raw material which the machine is capable to process, ~~it requires~~ a mechanical force is used to push the raw materials into the ~~Reactor~~ reactor; the source of this mechanical force can be also, hydraulic, pneumatic, colic, ~~o-by-the-or~~ use of a screw conveyor. However, those devises needed the devices to apply this mechanical force; are not claimed as our invention.

Also, our machine is conceived to process a mixture of inorganic and organic waste containing as minimum 80% plastics of any type, form or quality and 20% sponge, rubber, synthetic ~~fivers~~ fibers, glass, metallic burrs, ~~five~~ fiberglass, paints, gluing materials and metallic pins; this 20% may contain up to 50% of polystyrene foam articles, and also this 20% may contain up to 50% (10% of the whole raw material's mix) of organic waste. The machine of Patent-WO92/08590 is conceived only for the purpose of densifying; ours is conceived for densifying and as well for producing useful materials for the construction industry.

Also a ~~Another~~ machine ~~under request~~ is known patent ~~from PCT application~~ WO02/38276, which has a similar device (hydraulic piston with pushing plate in the end of the rod), ~~but we do not in our invention, we don't pretend to~~ claim the piston and the pushing plate as our invention.

BRIEF DESCRIPTION OF THE DRAWINGS

The characteristics of this new machine and its process are clearly shown in the following description and in the figures attached hereto. Each one of its parts has a reference number in order to be compared to the figures, in which:

Figure 1: Is a general view of the machine, with each one of its parts.

Figure 2 is a ~~Three-dimensional~~ perspective view of the ~~Reactor~~ reactor (8), ~~must be observed that its~~ whose walls are formed by ~~Chambers~~ chambers (21) and (22).

Figure 3 is a plant view of the ~~Reactor~~ reactor.

DETAILED DESCRIPTION

Referring to Fig. 1, ~~the~~ The machine for recycling inorganic trash is ~~enformed by~~ has one metallic structure or chassis (1) that is used as general support for the equipment, including a control switchboard (2) where the electromechanical elements that govern the equipment are installed and as required, they accomplish their function automatically, semi-automatically or manually, depending on the stage of the process.

This switchboard (2) controls the filling of raw material, the ignition, the operation temperature and each one of the stages of the process; it controls the heat level for the ignition of the cool system in regular temperature, in this case the switchboard (2) is built with electromechanical devices in order to govern the operation of the machine and it can be governed by computer as well.

The machine has an hydraulic piston (3) which ~~is the one that~~ generates the force and the pressure; and for achieving it, the piston (3) in its ~~movi-~~ moving part has a pushing plate (4) made up of steel, strong enough in order for the pressure of the piston (3) not to deform it, ~~theit~~. The piston (3) can be ~~substituted~~ replaced by a force input, either mechanical, pneumatic, ~~aeehan~~ aeolian colic, hydraulic, transporter worm or spindle; the pushing plate (4) is a steel plate ~~which-whose~~ shape will depend on the form of the ~~receptor-camera~~ receiving chamber (6) ~~of-for~~ the raw material, ~~in~~. In ~~which this~~ case it is of circular form, it transmits the mechanical force that the piston applies (3), pressing and carrying the raw material towards the ~~eamera-chamber~~ (6). Raw material is deposited previously under the pushing plate (4) by a feeder worm (5); it is formed by a metallic tube; the worm (5) helps to introduce to the ~~eamera~~ chamber (6) the raw material that is processed; said worm (5) is connected ~~in-at~~ its other ~~edge~~ end to a feeder system of raw material, this latter one ~~is-not being~~ part of the machine. The ~~reception-camera~~ of-receiving chamber for the raw material (6) is a tube or a container in which the raw material is deposited to be processed and inside it, the piston delivers its force (3) in order to push with the pushing plate (4) the raw material that is being processed and introduces it into the reactor (8), ~~likewise, the~~ The chamber (6) has a flange (7) ~~in-itsat~~ its top edge, which is a ring of steel, attached to the ~~receptor-camera~~ receiving chamber (6) and helps to join the ~~eamera-chamber~~ (6) with the reactor (8).

The reactor (8), is ~~the newest and most important part of the machine, that consists in an~~ equipment of cone shape, made up of steel; however, it can be made up of brass or aluminum. Referring to Figs. 2 and 3, ~~its~~ which walls are formed by two chambers (21) and (22) ~~which in term, these having inner and outer walls (19) which are hollow, hollow;~~ in other words, it has double walls, ~~through~~ Through the interior wall some ~~eonduets~~ conduits are connected (20) that can be rounded, triangular, squared, ~~in other words, they can be or~~ polygonal, ~~in in shape.~~ In this case, ~~as seen in Figs. 2 and 3, the eonduets-conduits (20) are triangular rounded.~~

Through ~~the this~~ conduits-conduits (20) and the hollow walls (19) it is circulating, like connecting cells, the heating element, hot oil, pushed by a pump (9). The reactor (8) is the equipment within which it is carried out a transfer of heat within a range of 250 to 350 centigrade degrees ~~between-from~~ the walls (19) of the chambers (21) & (22) and the ~~eonduets-conduits~~ (20), ~~and-to~~ the raw material. It is not determined an exact level of temperature, since the raw material is of all kinds, forms and characteristics, the points of softening vary too much. The reactor (8), transforms the raw material by means of the heat, into a puddle mass, softening, agglutinating ~~y-and~~ and homogenizing all of the materials, which once they have passed through the reactor, and still hot, are vacated through an exit ~~overture-opening~~ (10) that is located ~~in-at~~ at the ~~farthest edge~~ lowest end of the reactor (8). The hot and puddle mass, when exiting, falls and fills the molds (11) which will give strength and mechanical resistance to the mass, in order to convert it into the previously selected products. The molds (11) are of different forms according to the piece or product that is required to be manufactured; the molds are not part of the machine, but are a ~~neecessary part~~ mentioned in order to explain the functioning of the machine. However, ~~the oil can be substituted~~ replaced, ~~which is~~ as the heating element, by other components such as steam or hot air.

The reactor (8); is of cone shape in order to allow the entrance of the raw material in its natural form, in other words, voluminous and with many ~~hollowspaces;~~ however, the materials, when being softened and agglutinated because of the heat, will make the spaces disappear as raw material enters into it, in other words, it will be compacted; the cone shape is essential in order to form a molding paste, when compacted. In the reactor (8) it is achieved a uniform

distribution of the heat, which transmits the heat to the raw material through all sides, ~~however.~~ However, such the raw material enters into the reactor (8) in a regular at ambient temperature, ~~therefore, so that when being incoming into~~ contact with ~~is corresponding~~ the connecting pipes (20) and the hollow walls (19) forming the chambers (21) and (22) ~~that trough its interior flows~~ having the heating element flowing therethrough, the raw material cools it; this is the reason why the pump (9) makes the heating element flow, forcing it to pass through the heater equipment (14), which increases again its temperature and such, once hot, continues its way, circulating, continuing its cycle in order to be introduced constantly through the chambers (21) and (22) of the walls (19) and the connecting pipes (20) of the reactor (8). ~~The~~ the raw material circulates through them in a labyrinthine form, and hence it is able to soften and homogenize itself as well as to form a molding paste which exits through the ~~erture opening~~ (10) continuously. The pump (9) makes that the heating element circulates through the tubes (12), through the ~~conducts conduits~~ (19) and walls (20), in other words, the tubes (12) are the means through which the heating means are circulating between the heater equipment (14) and the pump (9); in this form a.

A sensor with thermometer (13) detects the temperature variations in the oil in order to maintain it at all times at the optimum operation temperature which is connected by tubes (12) with the heater equipment (14); the sensor (13) sends signals to the heater equipment (14) in order to maintain the temperature ~~in for~~ the specific needs that are to be required. Since the heater equipment (14) is the one that heats and reheats the oil that is circulating, this equipment can also work with: gas, carbon, diesel, fuel oil or logs. The machine also has a ~~Sensor sensor or draining~~ (15) that is connected by the tubes (12) to the rest of the machine, this sensor ~~or draining~~ (15) is an electro-mechanical device which detects if the level of cool oil at an ~~ambient regular~~ temperature is in an optimum condition, in order to turn on the machine, ~~since and~~ if the oil is under its required level, the machine will not turn on.

The machine has as well installed a compensation tank (16) which is connected to the rest of the equipment through the tubes (12); the function of the compensation tank (16) is to absorb the enlargement carried out in the oil due to a natural reason when heating. ~~Such- The compensation tank shall has have~~ a volume

of at least; two times the volume of operating cool oil, likewise, it is connected to a tube ~~with a hole of vent with cap~~ connecting to a cap with a vent hole (17) in order to discharge into a container as a safety measure, if the enlargement of the oil is too high, disconnecting the system through this hole (17); the necessary air enters and exits in order to maintain the atmosphere's pressure to the heater element. The machine has also ~~some~~ sensors (18) that are two; the first one helps to detect the moment in which it is required to ~~ignite start~~ or stop the feeder worm (5), when ~~such~~ the receiving chamber (6) is full or empty ~~the receptor camera~~ (6) as the case may be. The second sensor (18), which is the sensor for ~~ignition starting~~ and turning off the stroke ~~of the plate~~ (4), controls the various positions of operation of the plate (4), in order to control the moment of re-initiation of the new operation cycle, and when a cycle is concluded, it sends a signal for initiation of the following cycle.

It is important to mention; that this machine is so versatile, that can function from an inclination angle between 30 and up to 90 degrees. Logically when being at 90 degrees it will be more efficient, since it will take advantage of the gravity. The essential components of the referred machine, are connected between them mechanically. The raw material, regardless of its characteristics, is always processed ~~it with~~ the same feasibility and efficiency, and; its product always results with the same qualities. Dimensions of the machine: diametrically and longitudinally, will depend on the volume that is intended to be processed, for example, we have the following prototype; the dimensions of the model with a capacity for processing a volume of approximately 300 Kg. per hour are: ten tons in the piston (3); pushing plate (4) of 80 cm of diameter and 5 cm of thickness, ~~receptor camera~~ receiving chamber (6) of eighty centimeters of diameter by one meter of length; and the reactor (8) of cone shape, with entrance diameter of eighty cm. by eighty centimeters of length, with exit ~~erture opening~~ (10) of 15 cm. All of ~~this these~~ components are made up of steel. However, scale models can be manufactured, with a capacity of 5 tons per hour. The structure or chassis (1) is designed in order to support all of the components and so that such work vertically, likewise, the machine can be installed and operated, either in the same place where the trash is generated or in the same public or private trash dump, or may even be portable. Other ~~qualities characteristics~~ of the machine are: that 90% of the components of the machine, ~~does not require~~

5 ~~are not required to be machined parts~~, since they are of structural and roller
~~kind hot-rolled standard steel types of parts~~. It does not have ~~parts that~~ wear out parts
 and, therefore, the useful life of the machine will be longer. Its manufacture,
 maintenance and operation cost are much more economical than the conventional
 recycling equipments; and ~~the raw material, is like flaws for other recycling~~
~~equipments, in that this machine, and method accept raw materials containing~~
~~impurities, which in other recycling machines would cause operating problems and~~
~~flaws in their output products; while the impurities in the such is its raw material for~~
~~its processes and afterwards it will be in the present case become part of its product,~~
 10 since regardless of the kind of raw material introduced in the machine, it works with
 the same efficiency and the resulting product is obtained with the same qualities and
 properties.

The machine has been described up to this point, however, this invention
 refers also to a process, since such is involved to the functioning of the machine in
 15 order to obtain the molding paste, product of this invention, which has the following
 stages:

First stage, recollection of inorganic trash, which is the raw material to be
 processed, it does not require previous cleaning but has to be: plastics, regardless its
 type, form, size, color, use or quality, physical state, new, used for domestic
 20 purposes or industrial ones, in amounts no less than 80%, the other 20% is
 composed by other materials, such as rubber, foam rubber, synthetic fabrics, burrs,
 glass, staples, paint, barren rocks, tags, glues or hasps. This mix of trash can contain
 up to 50% of dry isop polystyrene foam articles, as already described above, in its
 different presentations.

25 The As also described above, the overall great amount of trash, can be
~~polluted contaminated by~~ up to 10% with organic trash, which could be composed of
 paper, sawdust, tree leaves, grass, cotton in its different presentations, wood spalls,
 liquid residuals, food, earth, soot and dust. Due to the fact that the dimensions of the
 raw material to be processed are so different, for example: when transformed into
 30 disposable items, the chairs, tables or large carafe, pads or switchboards and auto
 parts, etc., when being voluminous, makes necessary, in order for the production to
 be efficient, to fragment all raw material and pass it through a screen (121).

The second stage is the introduction of the raw material once fragmented into the machine, through the feeder worm (5); the machine turns on through the control switchboard (2), it is verified by means of the sensor ~~or draining~~ (15), if the level of the heating element is ~~in~~ at an optimum point for operation, and the pushing plate in

5 the top (4), the machine turns on, heats the heating element by means of the heater equipment (14), makes it circulate by means of a pump (9) through the tubes (12) that connect such with the reactor (8). The feeder worm (5) takes the raw material and introduce it under the pushing plate (4). The pushing plate (4) transmits the mechanical force that is applied to the piston (3) pushing and carrying the raw

10 material to the interior of the ~~camera~~ chamber (6), once inside it, continues to be pushed and compressed by the pushing plate (4) until it begins to be introduced into the reactor (8). The reactor (8) has the function to transform the raw material by means of heat, into a puddle mass, agglutinating and homogenizing all of the materials, which once processed and still hot and in a form of paste, are vacated

15 through the exit ~~erture~~ opening (10) located in the ~~edge~~ bottom end of the same.

Third stage: The puddle mass when exiting, fills the molds (11). The paste in the molds (11) remains in excess in the top, therefore, it is necessary to press it when it is still hot. When this part of the material is pressed, the remaining hollows if any, are filled and with such it can be obtained a better finishing and a higher mechanic

20 resistance in the products. The cooling process of the products will depend on the size and thickness of the pieces. For example, a 2cm-thick piece by 10cm- width and one meter-long, will take approximately 10 minutes to cool. A sleeper will take 40 minutes to cool. The product, once cooled has a mechanic resistance towards

25 compression that varies form 70 to 100 Kg/cm² per square centimeter.

Among the new elements of this process are: that it does not require water in any of its stages, nor any other element but heat and strength, neither does it requires that the raw material that is being processed has to be washed or cleaned, not even the place where the machine has to operate. It does not require special hygienic

30 conditions. Likewise, it does not pollute the environment, since it does not produce residuals of any type or kind. The versatility of the raw material, the design, functioning, way of process, molding paste and the final products that can be

manufactured by such, are the new element of this invention, since it converts mixed and polluted trash, into new products, which can be commercialized.

As described above, the machine and the process together converts the wastes into a hot molding paste, the paste is formed by: 80% plastics, 20% of other
 5 inorganic wastes, such as rubber, staples, etc.; and up to 10% can be organic trash which can contain the rest of the wastes, that when cooling, is transformed in wood substitutes and construction materials, for example: bricks, vaults, floors, paving blocks, tiles, floor edges, columns, racks, staves, ground-sills, boards, planks and walls, as well as beams, mudsills, divisions, parts for furniture and automobile
 10 industry, sewers, frames, doors, windows, mallets, cans, benches, ornament items, etc.

All of these products generally will be formed by a single piece, however, if being doors or frames, they will be of two or more pieces, but most of the times, when exiting the molds, they will be ready to be assembled. Such will depend on
 15 the design and characteristics of the mold where the mass will be poured.

Likewise, the final products made up of this molding pastes based on inorganic waste, has the following qualities: are not ~~rotten~~-rotted by humidity, ~~moth~~termite, are not corrupted and can be cut, machined, shaped, brushed, filed, drilled, painted, sandpapered and polished; mended, assembled, screwed, glued,
 20 tapped and recycled.

On the other hand, ~~this~~-these products can be painted, however the natural colors of these new products will have the predominant colors of the raw material. Another advantage of this products is that they do not need any other element, but heat and pressure, in order to be resistant and to have the desired form, it does not
 25 need time for forging, nor elements such as glues, solvents, substances or chemical products. It is so versatile that a lot of raw material which is introduced in order to be processed, will be ready to be used in one hour, therefore, it is quick, easy and economic.

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ABSTRACTSUMMARY

This invention refers to a machine and a process for recycling inorganic and organic trash and ~~obtention of~~ obtaining a molding paste, for different usages, this

5 The machine is formed basically by ~~one~~ a hydraulic piston, a pushing plate, a ~~receptor camera, one~~ receiving chamber, a reactor, ~~one~~ a pump and a heater equipment. Likewise, ~~said the~~ machine is involved in a process, ~~which stages are~~ essential in order to obtain the hot molding paste with the adequate characteristics; that when ~~cooling~~ cooled, is transformed into products ~~substituting that~~ substitute for

10 wood and materials for construction; such as bricks, vaults, floors, paving blocks, tiles, floor edges, etc. ~~This~~ These products will not be corrupted by humidity or ~~moth~~ termites, do not become rotten and can be cut, machined, etc. ~~This~~ The

15 machines does not require water in its industrial process, nor requires to ~~wash~~ washing the trash that is processed, does not pollute, has a low operation cost, ~~since it is~~ efficient and can be operated by just one person. This invention will benefit people and the environment, ~~since by reusing trash can be re-used and will~~ avoid avoiding the use of ~~and end with~~ natural resources.